PATENT ABSTRACTS OF JAPAN

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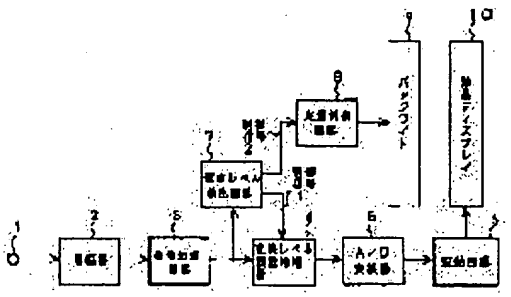
(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To easily maximize contrast and to reduce heat generation and power consumption by controlling light quantity in proportion to the maximum luminance level of an input video signal.

SOLUTION: A luminance level detecting circuit 7, upon detecting the maximum level of luminance is for example 100 IRE from a Y signal in a signal processing circuit 3, transmits to a conversion level adjusting amplifier 4 a control signal 1 that sets the gain at one, and also transmits to a light quantity control circuit 8 a control signal 2 that sets the light quantity of the back light 9 at 100%. Then, in the case where a signal is inputted corresponding to the maximum level luminance 30% (30 IRE) from an inputting part 1, this signal is amplified by an amplifier 2 and processed by the signal processing circuit 3, while the luminance level detecting circuit 7, upon detecting the maximum level of the luminance is 30 IREV from the processed Y signal, transmits to the conversion level adjusting amplifier 4 the control signal 1 that increases the gain 100/30=3.3 times, and also transmits to the light quantity control circuit 8 the control signal 2 that sets the light quantity of the back light 9 at 30%.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the liquid crystal display which the brightness of a lighting means was changed according to the video signal, and made the contrast expression easy especially about a liquid crystal display.
[0002]
[Description of the Prior Art] A liquid crystal display [Liquid crystal display] is a display using liquid crystal (body with the middle property of a solid-state and a liquid), and when an electrical potential difference is applied among the properties which liquid crystal has, it is a display using the array of a molecule changing. The array of a molecule is changed applying an electrical potential difference to the liquid crystal inserted between the glass plates of two sheets, and light is made to penetrate or it displays by making it reflect.
[0003] Thin-shape-izing is possible for such a liquid crystal display, and it has the advantage that power consumption is small. Taking advantage of this advantage, it is put in practical use to OA equipment, a television receiver for home use, etc. with a liquid crystal display which are represented by the laptop computer, and is spreading. However, since a liquid crystal display is nonluminous, it is inconvenient to use in a dark place. It is necessary to surely prepare the back light which illuminates a display screen from a tooth back in order to enable improvement in conspicuousness, and use in a dark place (in the case of a transparency mold liquid crystal display).
[0004] a liquid crystal ingredient and orientation -- a way -- there is a ****** class. When it roughly divides, there are the mode in which light modulation is performed using a polarizing plate using change of the birefringence effectiveness by electric field, and the mode (a polarizing plate is unnecessary) in which light scattering is used. The general thing at the former is in TN (twisted nematic) mode, and if it combines with an active matrix, it can realize high definition. Although some modes are proposed in the passive matrix in order to secure image quality, the thing using STN (supertwisted nematic) which improved TN mode is the existing mainstream. Moreover, as a thing using the latter light scattering, macromolecule distributed process input output equipment is proposed, and attention is attracted recently.
[0005] Drawing 6 is the block diagram showing the configuration of the conventional liquid crystal display. As shown in drawing 6 , the configuration of the conventional liquid crystal display is constituted by the back light 17 as a lighting means to irradiate the digital disposal circuit 13 which performs Y/C separation processing of the amplifier 12 which amplifies the video signal inputted from the input section 11, and the amplified video signal etc., A/D converter 14 which carries out analog-to-digital conversion of the image **** by which signal processing was carried out, the drive circuit 15 of a digital input, the liquid crystal display 16 of a transparency mold, and a liquid crystal display 16 etc.
[0006] A liquid crystal display 16 has the configuration which stuck the glass substrate of a pair mutually as an example, and liquid crystal is enclosed with both gap. To a front-face [of a glass substrate], and rear-face side, the polarizing plate is arranged and a desired image is projected in

response to the intensity modulation by the drive circuit 15.
[0007] In order that the back light 17 arranged by approaching a liquid crystal display 16 may improve color purity of a liquid crystal display 16, a cold cathode lamp or a hot cathode lamp using the three-wave fluorescent substance which fitted the spectral characteristic to the spectral characteristic of the color filter of a liquid crystal display 16 etc. is used.
[0008] By the way, when outdoor daylight uses a liquid crystal display as the liquid crystal display for mount which changes from the brightness of the sunlight of day ranges to the brightness of the room light of Nighttime, or a home television receiver, in order to keep the conspicuousness of the display screen constant, it is necessary to adjust the brightness and the contrast ratio of a screen correctly.
[0009] In the indicating equipment which used the conventional liquid crystal display, the brightness of lighting means, such as a back light and a lamp for projection, was always fixed. Therefore, in the case of a dark image, the light from a lighting means will almost be intercepted upwards, and a feeling of contrast also had the problem that it could not express enough.
[0010] Furthermore, in the conventional approach, since the brightness of a lighting means is always kept constant, the lighting means is maintaining the brightness at max also on the dark screen. For this reason, when displaying a dark image, a feeling of contrast was not able to be enough expressed from the property limitation of a liquid crystal display. Moreover, since the great portion of light emitted from the lighting means would be intercepted with a liquid crystal display when displaying a dark image, generation of heat inside a liquid crystal display became large, as a result, the loss became large and power consumption also had the problem of becoming large.
[0011]
[Problem(s) to be Solved by the Invention] Since the great portion of light which could not express a feeling of contrast enough and was emitted from the lighting means on the dark screen since the brightness of a lighting means was always kept constant with the conventional liquid crystal display like **** was intercepted with a liquid crystal display, generation of heat inside a liquid crystal display was large, and power consumption also had the problem of becoming large.
[0012] In this invention, this point is solved, and the contrast of a liquid crystal display can always be demonstrated to max by the comparatively easy approach, and let generation of heat of a liquid crystal display, and implementation of the liquid crystal display which reduced power consumption be technical problems.
[0013]
[Means for Solving the Problem] In the liquid crystal display which has a lighting means by which this invention illuminates a liquid crystal display and said liquid crystal display, and a signal-processing means to process an input video signal and to make it display on said liquid crystal display in order to attain the above-mentioned purpose A brightness detection means to detect the greatest intensity level of said input video signal, and a magnification means to amplify the output video signal of said signal-processing means to predetermined level according to the greatest intensity level of said input video signal which this brightness detection means detected, and to input into said liquid crystal display, It is characterized by providing the quantity of light control means which controls the quantity of light of said lighting means in proportion to the greatest intensity level of said input video signal which said brightness detection means detected.
[0014]
[Embodiment of the Invention] Hereafter, an accompanying drawing is made reference and the liquid crystal display concerning this invention is explained to a detail. First, the graph which expresses the image expression approach of the conventional liquid crystal display to drawing 1 was shown. The brightness of a lighting means is always kept constant and expresses the video signal to the liquid crystal display as the conventional approach as it is. Therefore, in the case of the bright screen of drawing 1 (a), the contrast of an image can express 100%, but on the dark screen of drawing 1 (b), with the contrast of the original video signal, the great portion of light which cannot express sufficient feeling of contrast (it can express only 30% by a diagram), and is emitted from a lighting means will be intercepted with a liquid crystal display, and the energy will be consumed within a liquid crystal display.

[0015] The image expression approach of the liquid crystal display in the gestalt of 1 operation of this invention was shown in the graph of drawing 2 . He is trying to change the brightness of a lighting means in this invention in proportion to the 1 field of the original image, or the maximum brightness within one frame. Moreover, in case a video signal is expressed to a liquid crystal display, the video signal was amplified and it has inputted into the liquid crystal display so that the maximum intensity level of the original video signal may serve as maximum of liquid crystal display contrast. Also in the case of the dark screen of drawing 2 (b), the contrast property of a liquid crystal display can be demonstrated by this to the maximum extent. As [intercept / moreover, / in order to adjust the brightness of the lighting means itself / on a dark screen, / with a liquid crystal display / the great portion of light which can be made to also penetrate without futility the light emitted from the lighting means and by which it was emitted from the lighting means like before]

[0016] Thus, by carrying out this invention, the image expression which demonstrated the contrast property of a liquid crystal display to the maximum extent can be attained, the futility of the lighting means intercepted with a liquid crystal display can be lost, and the fall of calorific value and the fall of power consumption can be realized.

[0017] Drawing 3 is the block diagram showing the configuration of the gestalt of 1 operation of the liquid crystal display of this invention. This liquid crystal display The amplifier 2 which amplifies the video signal inputted from the input section 1, the digital disposal circuit 3 which processes the amplified video signal, and the video signal by which signal processing was carried out to the optimal level for A/D conversion The conversion level adjustment amplifier 4 and the conversion level adjustment amplifier 4 to amplify The drive circuit 6 which drives a liquid crystal display based on A/D converter 5 which carries out analog-to-digital conversion of the video signal inputted by passing, and the digitized video signal, the liquid crystal display 10 of a transparency mold, and the maximum level of the luminance signal from a digital disposal circuit 3 are detected. The control signal 1 which makes it in inverse proportion to the maximum level of a luminance signal, and makes the gain of the conversion level adjustment amplifier 4 amplify, The intensity-level detector 7 which sends out the control signal 2 to which it is made to be proportional to the maximum level of a luminance signal, and the quantity of light is changed, It consists of a quantity of light control circuit 8 which controls the quantity of light of a back light 9 according to the control signal 2 from the intensity-level detector 7, and a back light 9 which illuminates a liquid crystal display 10 from behind.

[0018] The correspondence to the input level of this liquid crystal display is explained. Now, the maximum level presupposes that the signal equivalent to 100% (100IRE) of brightness was inputted from the input section 1. This signal is amplified with amplifier 2 and signal processing, such as Y/C separation processing, is performed by the digital disposal circuit 3. The intensity-level detector 7 will send the control signal 2 which makes the control signal 1 which makes the gain the conversion level adjustment amplifier 4 1 delivery and the quantity of light control circuit 8, and makes 100% the quantity of light of a back light 9, if it detects that the maximum level of brightness is 100IRE(s) from a Y signal by the digital disposal circuit 3. Thereby, the peak of a video signal is made 100%, A/D converter 5 is convertible on the level near the input maximum conversion level, and a back light 9 illuminates a liquid crystal display 10 on the brightest level.

[0019] Next, the maximum level presupposes that the signal equivalent to 30% (30IRE) of brightness was inputted from the input section 1. This signal is amplified with an amplifier 2, signal processing is carried out by the digital disposal circuit 3, and the intensity-level detector 7 will send the control signal 2 which makes the control signal 1 which increases that gain the conversion level adjustment amplifier 4 100 / 30= 3.3 times delivery and the quantity of light control circuit 8, and makes 30% the quantity of light of a back light 9, if it detects that the maximum level of brightness is 30IRE(s) from the processed Y signal.

[0020] By this, 30% of input is amplified 3.3 times with the conversion level adjustment amplifier 4, the peak of a video signal becomes 100% also in this case, and A/D converter 5 is convertible on the level near that input maximum conversion level like the case of 100% of brightness. A back light 9 illuminates a liquid crystal display 10 with 30% of brightness.

[0021] Thus, with the liquid crystal display of this invention, on the maximum level of an input video signal, it penetrates completely without a liquid crystal display's 10 interrupting the quantity of light of a back light 9 regardless of the absolute value. In order to make this relation intelligible, the video-signal wave the case of the signal input of the 30% of the maximum brightness in the conventional liquid crystal display and in the signal input of the 30% of the maximum brightness in the gestalt of this operation, the brightness of a back light, the contents of a display, etc. were typically shown in drawing 4 and drawing 5 .

[0022] Even after passing through a digital disposal circuit 13 in the former of drawing 4 , the peak level of a video signal (b) not being different from an input video signal (a). Moreover, it is fixed with the greatest brightness and he was trying for the brightness of a back light 17 to also cover the brightness with a liquid crystal display 16. Consequently, a display image as shown in (c) to the input video signal shown in (a) is acquired.

[0023] As shown in drawing 5 in the case of the gestalt of operation of this invention, the peak level of the video signal (b) inputted into a liquid crystal display 10 through a digital disposal circuit 3 and the conversion level adjustment amplifier 4 to an input video signal (a) is maintained at the maximum of a liquid crystal display input, and, on the other hand, the brightness of a back light 9 is pressed down by 30% of the greatest brightness in this case controlled according to the peak of an input video signal (a). Therefore, the display image (c) of the quantity of light which is not different from the case of the former of drawing 4 , or is covered with a liquid crystal display 10 to an input video signal (a) has decreased far. Therefore, there is less generation of heat of a liquid crystal display 10 than the conventional case, and power consumption can also reduce it.

[0024] Since the image display which always demonstrated the contrast property of a liquid crystal display to the maximum extent by always keeping constant the maximum of signal level which controls a liquid crystal display, and changing the brightness of a lighting means in proportion to the maximum of the original video signal conversely becomes possible and the brightness of a lighting means is maintained at necessary minimum as stated above, the reinforcement of a lighting means, low-power-izing, and the fall of calorific value are also realizable for coincidence. Moreover, since such technique can completely be performed automatically, the need of adjusting contrast over an input signal with a help completely becomes unnecessary.

[0025] This invention can take the gestalt of various operations besides the gestalt of the above operation. For example, although the above explanation explained as a liquid crystal display of a transparency mold as a liquid crystal display 10, except that the locations of a back light 9 differ, the same is completely said of the liquid crystal display of a reflective mold. Moreover, it cannot be overemphasized that it can develop into various gestalten also points other than this.

[0026]

[Effect of the Invention] As explained above, this invention is the liquid crystal display which has a liquid crystal display, a lighting means to illuminate a liquid crystal display, and a signal-processing means to process an input video signal and to make it display on a liquid crystal display. A magnification means to amplify the output video signal of a signal-processing means according to the greatest intensity level of the input video signal which a brightness detection means to detect the greatest intensity level of an input video signal, and this brightness detection means detected so that that greatest intensity level may turn into predetermined level, and to input into a liquid crystal display, The quantity of light control means which controls the quantity of light of a lighting means in proportion to the greatest intensity level of the input video signal which the brightness detection means detected was established. Let the greatest intensity level of the input video signal which a brightness detection means detects here be the greatest intensity level for example, in one frame. Thus, in this invention, since the quantity of light of a lighting means is adjusted according to the greatest intensity level of an input video signal, the image display which always demonstrated the contrast of a liquid crystal display to the maximum extent is realizable. Moreover, generation of heat which lessens the rate which intercepts the light from a lighting means with a liquid crystal display, makes loss of a lighting means min, and is generated with a liquid crystal display can be reduced, and power consumption can be reduced.

Moreover, since the quantity of light of a lighting means is adjusted according to the greatest intensity level of an input video signal, the conversion efficiency of an A/D converter and the display capacity of a liquid crystal display can always be efficiently employed in the maximum.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The graph showing the image expression approach of the conventional liquid crystal display.
[Drawing 2] The graph showing the image expression approach in the gestalt of 1 operation of the liquid crystal display of this invention.
[Drawing 3] The block diagram showing the configuration of the gestalt of 1 operation of the liquid crystal display of this invention.
[Drawing 4] The mimetic diagram showing the video-signal wave in the signal input of the 30% of the maximum brightness in the conventional liquid crystal display, the brightness of a back light, the contents of a display, etc.
[Drawing 5] The mimetic diagram showing the video-signal wave in the signal input of the 30% of the maximum brightness in the gestalt of 1 operation of the liquid crystal display of this invention, the brightness of a back light, the contents of a display, etc.
[Drawing 6] The block diagram showing the configuration of the conventional liquid crystal display.
[Description of Notations]
1 -- input section, 2 -- amplifier, and 3 -- a digital disposal circuit, 4 -- conversion level adjustment amplifier, 5 -- A/D converter, and 6 -- a drive circuit, 7 -- intensity-level detector, 8 -- quantity of light control circuit, and 9 -- a back light, 10 -- liquid crystal display, 11 -- input section, and 12 -- an amplifier, 13 -- digital disposal circuit, 14 -- A/D converter, and 15 -- a drive circuit, 16 -- liquid crystal display, and 17 -- back light.

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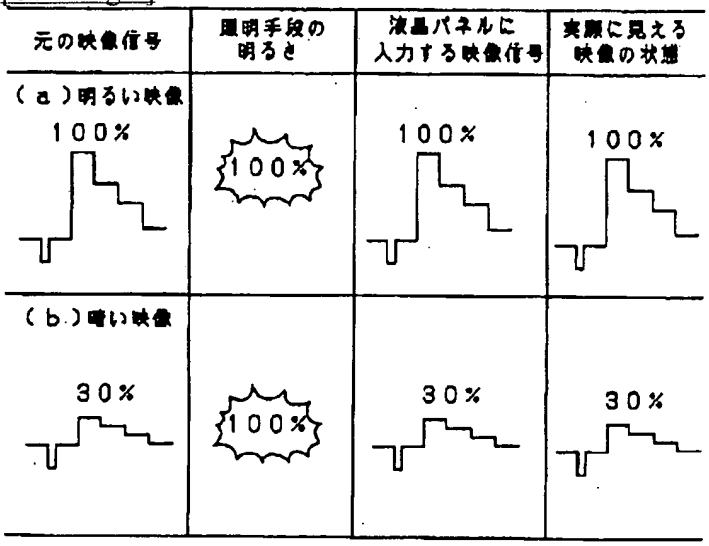
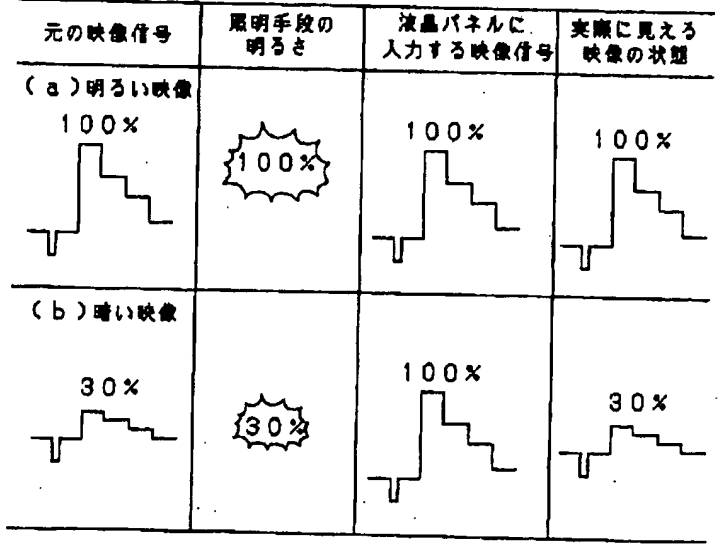
DRAWINGS

[Drawing 1]



[Drawing 2]



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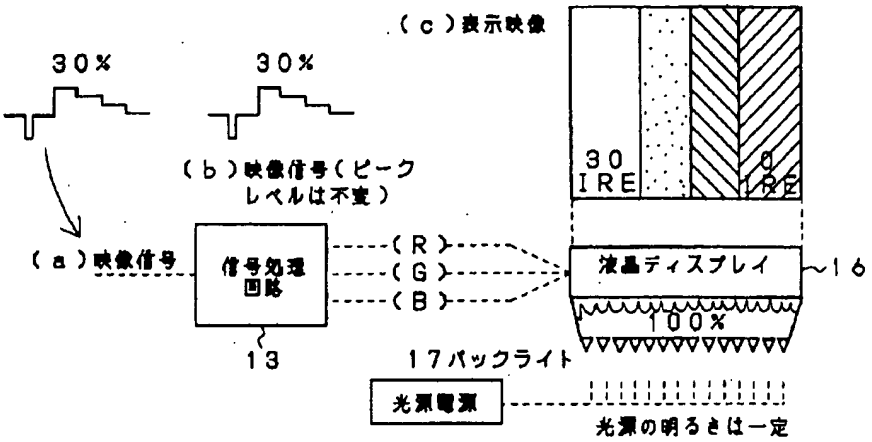

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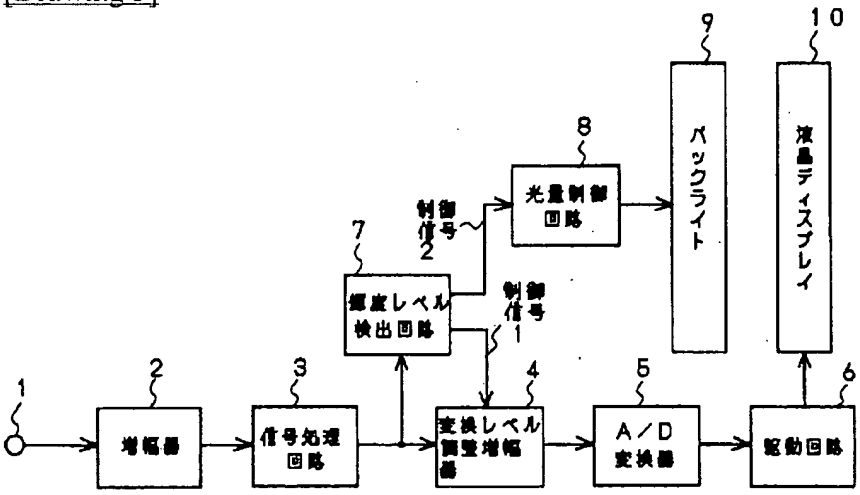
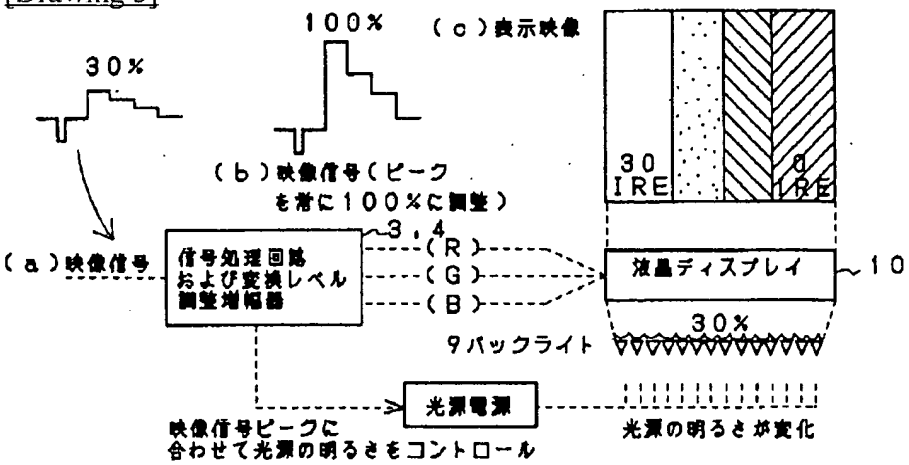
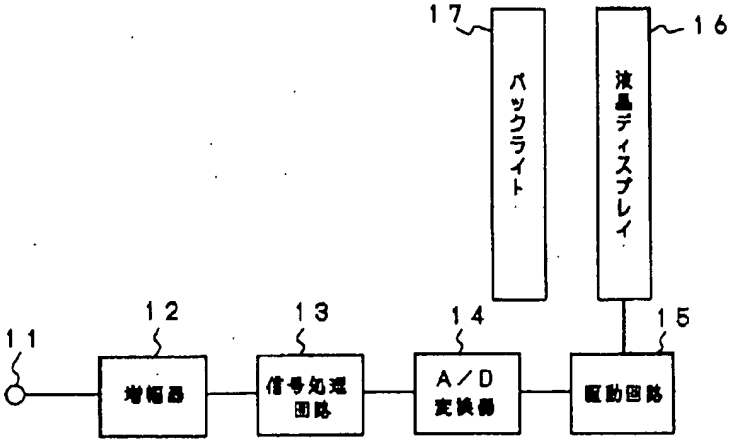


[Drawing 5]



[Drawing 6]



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